

## Physician On-Line Readiness Guide:

Until recently, contamination of water with biological, chemical or radiologic agents generally resulted from natural, industrial or unintentional man-made accidents. **Unfortunately, recent terrorist activity in the US has forced the medical community, public health agencies, and water utilities to consider the possibility of intentional contamination of US water supplies as part of an organized effort to disrupt and damage important elements of our national infrastructure.** In his 2002 State of the Union Address, President Bush noted that confiscated Al Qaeda documents included detailed maps of several US municipal drinking water systems. Apprehension regarding a terrorist assault on drinking water has also been reinforced by news reports and recent arrests of suspects charged with threatening to poison water supplies in the US. In addition, the National Academy of Sciences reported to Congress that water supply system contamination and disruption should be considered a possible terrorist threat in the U.S. As a result of these reports, there continues to be concern that **water may represent a potential target for terrorist activity and that deliberate contamination of water is a potential public health threat.**

Although detection methods for recognizing intentional contamination of a water supply are improving, the most likely initial indication that a water contamination event has occurred in a community will be a change in disease trends and illness patterns. **Practicing healthcare providers are likely to be the first to observe these unusual illness patterns and must understand their critical role as "front-line responders" in detecting water-related disease resulting from biological, chemical or radiological terrorism.** Healthcare practitioners provide an "early detection system" for possible exposure to weapons of mass destruction -- since humans continue to remain the most sensitive and often the only "detector" of a covert terrorist attack on our population. Early recognition, accurate diagnosis, and conscientious case reporting by community healthcare providers of suspected waterborne disease cases -- no matter what their clinical specialty -- will be critical to maintaining water security and safety and to protecting the nation's public health in the future.

Although it is not realistic to believe that healthcare providers can prevent the first cases of illness resulting from intentional acts of water terrorism, we could play a critical role in **minimizing** the impact of such an event by practicing medicine with a heightened level of suspicion that such an attack could occur in our community. **With prompt diagnosis, proper management, and collaboration with public health and water authorities, prepared healthcare professionals may make the difference between a controlled response to an act of water terrorism versus a public health crisis.**

A coordinated and effective response to acts of water terrorism will depend upon cooperation among a multidisciplinary team of healthcare providers, public health and water utility practitioners, law enforcement professionals and community leaders in order to mitigate the potential impact of an intentional contamination event. In order to respond to a potential act of waterborne terrorism, healthcare providers must have access to immediately accessible and constantly updated information. **The primary purpose of this Physician Readiness for Acts of Water Terrorism guide is to address this critical need and provide healthcare practitioners with streamlined access to resources that will help guide them through the recognition, management and prevention of water-related disease resulting from intentional acts of water terrorism.**

## PHYSICIAN PREPAREDNESS FOR ACTS OF WATER TERRORISM

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### SECTION 1

#### Purpose of Physician Readiness Guide for Acts of Water Terrorism



#### How Real is the Terrorist Threat to U.S. Water Supplies and Public Health?

Until recently in the United States, contamination of water reserves and public drinking water systems with biological, chemical or radiologic agents generally resulted from natural, industrial or unintentional man-made accidents. **Unfortunately, recent terrorist activity in the U.S. has forced the medical community, public health agencies and water utilities to consider the possibility of intentional contamination of U.S. water supplies as part of an organized effort to disrupt and damage important elements of our national infrastructure (1-3).** In the past, protection of potable water supplies from intentional nuclear, biological or chemical (NBC) contamination was a concern for the military tasked with protecting troops from known and potential NBC weapons exposure in the field (4-6). Now there is growing concern that chemical, biological, and radiological weapons may be used against the U.S. civilian population with water

as one possible vehicle of transmission or mode of dispersal of these weaponized agents (1, 2, 7, 8).

In his 2002 State of the Union Address, President Bush noted that captured Al Qaeda documents included detailed maps of several U.S. municipal public drinking water systems (9). Apprehension regarding a terrorist assault on drinking water systems has also been reinforced by news reports and recent arrests of suspects charged with threatening to contaminate municipal water supplies in the U.S. (3,10-13). In addition, as part of their 2002 congressional report, the National Research Council of the National Academy of Sciences concluded that water supply system contamination and disruption should be considered a possible terrorist threat in the U.S. (14). As a result of these reports, there continues to be concern that water may represent a potential target for terrorist assaults and that deliberate contamination of water is a potential public health threat. **No matter how minor the contamination event or short-term the disruption to the delivery of safe drinking water, the psychological, medical, and potential public health impact on the U.S. population could be significant.**

Most recently on February 7, 2003, the National Terrorism Threat Level was increased to a "high risk" threat level based upon information received and analyzed by the federal intelligence community (15). Subsequent to this heightened alert, the Centers for Disease Control and Prevention (CDC) and the Environmental Protection Agency (EPA) issued the following **Water Advisory in Response to the High Threat Level** (16).

This is an official

## CDC Health Advisory

Distributed via Health Alert Network  
February 07, 2003, 20:56 EDT (8:56 PM EDT)  
CDCHAN-000113-03-02-07-ADV-N

### **CDC and EPA Water Advisory in Response to High Threat Level**

Today, the Department of Homeland Security upgraded the Homeland Security Advisory System from yellow level (elevated risk of terrorist attack) to orange level (high risk of terrorist attack).

**While there are no data to indicate that water has been specifically targeted,** our nation's water infrastructure remains at risk to terrorist attacks, or acts intended to substantially disrupt the ability of a water system to provide a reliable supply of water. Therefore, public health agencies and water utilities are encouraged to continue to work together, keep each other informed of any unusual activities, and confirm the proper operation of notification channels in emergency response plans.

Public health agencies should immediately notify local water utilities and the state's drinking water administrator in the event of an unusual number of cases of gastrointestinal illnesses or other indications of illness that may suggest water contamination by a biological, chemical or radiological agent.

Water utilities should immediately notify public health agencies 24/7 emergency operations number, and the state's drinking water administrator in the event of specific threats received at a water facility, customer complaints in water quality, or if circumstances lead the utility to believe that the water has been or will be contaminated with a biological, chemical or radiological agent.

The Centers for Disease Control and Prevention (CDC) and the U.S.

Environmental Protection Agency (EPA) issue this advisory jointly.

Categories of Health Alert messages:

**Health Alert:** conveys the highest level of importance; warrants immediate action or attention.

**Health Advisory:** provides important information for a specific incident or situation; may not require immediate action.

**Health Update:** provides updated information regarding an incident or situation; unlikely to require immediate action.

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Overt and covert acts of terrorism involving weapons of mass destruction (WMD) pose an intimidating public health threat and a significant challenge to our healthcare infrastructure as was demonstrated following the intentional release of *Bacillus anthracis* spores through the U.S. postal system in 2001 (17). Although significant progress has been made to improve the preparedness skills of the medical and public health community in the U.S., **the majority of healthcare providers still have limited clinical experience with the recognition and management of the type of biological, chemical and radiologic agents that terrorists may use to threaten the U.S. civilian population** (18). Most public health and law enforcement authorities consider a successful attack using weapons of mass destruction in the U.S. “simply a matter of time” (19). Therefore, we can no longer assume that such an attack will never happen (20) and we must be prepared for the significant responsibilities that we will face as healthcare providers in the event of a terrorist assault.

### Clinical and Diagnostic Challenges Resulting from the Threat of Water Terrorism:

As healthcare providers, it is not realistic to believe that we can prevent the first cases of illness or injury resulting from a WMD attack but we may play a critical role in minimizing the impact of such an event by practicing medicine with an increased index of suspicion that such an attack may occur in our community (19, 21). Even if the probability of occurrence remains low, the public health consequences of a successful covert or overt attack would be serious (22). **With prompt diagnosis and proper management including preventive and therapeutic measures, prepared healthcare professionals may be the difference between a controlled response to a terrorist incident versus a public health crisis** (23).

Therefore, early detection and rapid response to biological, chemical or radiologic terrorist assaults on the nation's infrastructure including U.S. water supplies are critical elements to any effective terrorism response strategy. This is particularly important when addressing the possibility of water contamination resulting from the current threat of terrorism. In this scenario, **early detection is paramount** in order to decrease the public health impact of a contamination event as well as the secondary disruption to water distribution and the psychological impact of the public's lack of confidence in water safety and quality (1).

Recognizing and treating waterborne disease and the health effects of acute and chronic exposure to water contamination is a diagnostic dilemma for the majority of practicing physicians in the United States - even in the best of circumstances - let alone in an emergency situation resulting from waterborne exposure to weapons of mass destruction. **Health care practitioners face many challenges when attempting to accurately diagnose and appropriately manage and treat waterborne disease and the sequelae of exposure to waterborne contaminants resulting from WMD exposure.** These significant challenges include but are not limited to the following scenarios:

- **Prompt identification of a terrorist assault on water supplies may be confounded by difficulties in early diagnosis.** Many WMD-related diseases present with vague, non-specific symptoms in the early phase of illness and may be difficult to differentiate from naturally occurring disease or typical symptoms associated with chemical or radiologic exposure from known sources (24). In addition, the signs and symptoms of waterborne disease and the health effects of water contamination are often non-specific and mimic more common medical conditions and disorders unrelated to water contaminant exposure (25).
- **Many WMD agents display a significantly different clinical picture when the route of exposure is ingestion presenting an additional diagnostic challenge to medical practitioners faced with addressing an intentional waterborne contamination event.** Using food and water supplies as a mode of dispersion for WMD (21, 24) may confound diagnosis, delay treatment and impede protective public health measures if clinical assessments are restricted to evaluation of inhalation and cutaneous routes of exposure alone (6, 19, 26).
- **The level of suspicion and diligence of healthcare providers will need to remain very high since future terrorist attacks on our civilian population may not follow an expected pattern of attack with respect to water.** A small outbreak of WMD-related disease or cluster of toxic exposure may portend warning of a more large scale attack. Water systems in small rural communities may represent “testing grounds” for larger scale attacks on metropolitan municipal systems. This potential scenario reinforces the integration of terrorism into the daily differential diagnosis of every physician in practice in the U.S. no matter how small or large the community (27, 28).
- **Healthcare providers will be challenged to obtain accurate exposure histories from symptomatic patients who may have been exposed to WMD agents through multiple exposure pathways including waterborne exposure.** The majority of biological, chemical and radiologic agents that may be used during an intentional contamination of water supplies are not unique to water. Most of the WMD agents may be distributed through multiple routes of exposure and may result from other sources of WMD dispersal in addition to the waterborne route. Moreover, public drinking water may represent only one source of waterborne exposure with deliberate contamination of recreational waters, swimming pools or even bottled water (6) also presenting a possible target of terrorist activity.
- **Water-related disease resulting from intentional contamination with biological, chemical or radiologic agents may present as benign symptoms or self-limited illness in a healthy patient population while the same waterborne exposure in a vulnerable patient population may result in significant morbidity and mortality.** The impact of a terrorist attack depends upon not only the type of agent used or method and efficiency of dispersal but also upon the type of population exposed and their level of immunity or vulnerability (6, 29). Individual vulnerability to weaponized compounds including waterborne agents may vary widely and differences in host susceptibility factors may complicate recognition of an intentional water contamination event. Unfortunately, these sensitive populations will experience the most drastic health outcomes from any biological, chemical or radiologic contamination event resulting from a terrorist assault on water supplies.

## Physicians and Healthcare Providers as “Front-line Responders” to Acts of Water Terrorism:

Early recognition and detection of WMD-related illness and injury by healthcare providers is obviously critical to any effective anti-terrorism preparedness strategy for the United States.

**Physicians and other healthcare practitioners continue to play a critical role as “front-line responders” particularly since the first casualties of covert terrorist activity are likely to be identified by the medical community heralding the initial indication of an attack (28, 30).** Healthcare practitioners provide the “early detection system” for possible exposure to WMD since humans continue to remain the most sensitive and often the only “detector” of a WMD attack on our population (30-32). Prompt disease recognition, appropriate treatment and conscientious case reporting by all physicians - no matter what their clinical specialty – represent key components to successfully combating a terrorist attack on the U.S. population and effectively protecting the nation's public health (17, 33, 34).

Practicing healthcare providers are likely to be the first to observe unusual illness patterns and must understand their critical role as "front-line responders" in detecting water-related disease resulting from biological, chemical or radiological terrorism as well. Although detection methods for recognizing intentional contamination of a water supply are improving (3), **the most likely initial indication that a water contamination event has occurred in a community will be a change in disease trends and illness patterns.** This probable scenario would potentially involve a community-wide waterborne disease outbreak or a cluster of water-related cases of chemical or radiologic toxicity in the general population. Therefore, practicing healthcare providers are likely to be the first to observe unusual illness patterns and injury from water-related disease resulting from biological, chemical or radiological terrorism (25). Early recognition, accurate diagnosis, and conscientious reporting by community healthcare providers of suspected waterborne disease cases will be essential to maintaining water security and safety.

Inaccurate assessment of the incidence of water-related disease resulting from WMD exposure may limit the successful implementation of water quality treatment and public health protection strategies in an affected community. As in any type of anti-terrorism preparedness (35, 36), a coordinated and effective response to acts of water terrorism will depend upon cooperation among a multidisciplinary team of healthcare providers, public health and water utility practitioners, law enforcement professionals and community leaders in order to mitigate the potential impact of an intentional contamination event. Healthcare providers will need to embrace their critically important role as active participants in this public health challenge in order to protect their patients and their community. **Emergency preparedness response plans addressing acts of water terrorism must include healthcare practitioners as critical stakeholders and essential members.**

In addition, as a result of heightened public awareness regarding the potential for additional terrorist activity, physicians and other healthcare providers will be required to play a leading role in risk communication with the public, if an act of waterborne terrorism occurs in the U.S. Healthcare providers are among the most trusted sources of information for the general public regarding drinking water quality and safety in the U.S. (25) and community residents will immediately turn to their healthcare providers for advice regarding the safety of their drinking water during an intentional contamination event. **Medical and public health practitioners will be faced with providing credible and timely risk communication** and public notification of a suspected water contamination event in light of the potential for significant concern in the general population resulting from such an event.

### **Physician Readiness and Education as One Defense for Acts of Waterborne Terrorism:**

The education of healthcare providers, public health officials and first responders will play a **crucial role in the prompt recognition, treatment, and prevention of the medical consequences of weapons of mass destruction exposure (36, 37).** Healthcare providers must become familiar with not only the clinical presentation, diagnosis, management and prevention of WMD-related disease in their patients but also the appropriate mechanisms for communicating with law enforcement agencies, public utilities, the media and the concerned public (38, 39).

Military physicians have routinely received training in the management of biological, chemical and radiologic disasters but now the civilian medical community must develop similar skills in order to respond to potential terrorist activity against the U.S. population (39, 40).

**Specialized training for healthcare providers and access to targeted information by the medical community will be essential to any effective response to acts of water terrorism** for several reasons:

- The illness and injury resulting from civilian exposure to weapons of mass destruction agents would not be part of any healthcare provider's routine clinical practice experience (36, 41, 42). A terrorist assault on water supplies may potentially involve use of weaponized and "exotic" or unusual biological or chemical agents.
- The majority of practicing physicians in the U.S. have received no formalized training in the recognition and evaluation of waterborne disease or in the management of the short and long-term health effects of water contamination (25).
- Most practicing physicians and healthcare providers are poorly prepared to detect water-related disease resulting from intentional biological, chemical or radiologic contamination and may not be adequately trained to respond appropriately to a terrorist assault on water (25).

In order to effectively develop and implement anti-terrorism strategies and disaster preparedness planning in the United States, this critical knowledge gap of the medical community must be addressed. **Educational tools for healthcare providers and preparedness training for the medical community are key elements to any anti-terrorism strategy that promises to protect water supplies and prevent waterborne disease in the general public resulting from intentional contamination (25).**

### **Objectives of this Physician Readiness Guide for Acts of Water Terrorism:**

The results of a recent national survey of approximately 1000 family physicians revealed that the **greatest predictor of being able to respond to bioterrorism was "knowing how to get information in the event of a suspected attack," including clinical information (43).** The need for immediate access to specialized information and reference materials by the medical community is particularly important when addressing the recognition and management of acts of water terrorism since the consequences of intentional contamination of drinking water could have serious public health consequences. In addition, the initial medical response required to address this type of terrorist activity would be an inherently local or regional challenge for healthcare systems and medical providers until external resources could become available. According to the American Medical Association, local medical responders including healthcare providers will potentially need to function unassisted for 6 to 8 hours until outside resources arrive in response to a terrorist attack (40).

Therefore, clinicians will need to have immediate access to constantly updated information in order to respond to the medical and public health needs of their community (42) subsequent to any act of water terrorism. **The primary purpose of this Physician Readiness for Acts of Water Terrorism guide is to address this critical need for streamlined access to resources that will help guide them through the recognition, management and prevention of water-related disease resulting from intentional acts of water terrorism.**

The changing nature of the terrorist threat that includes the continuing emergence of exotic and weaponized agents as well as new modes of dispersal requires specific attention to current and consistently up-to-date reference information. This physician on-line readiness guide has been developed in order to provide access to clinically relevant and updated information in a format that offers easy access to practicing physicians in a clinical setting. This web-based program has

been peer-reviewed by medical, public health and military specialists and has been developed and referenced with peer-reviewed journal articles. The on-line readiness guide provides the following educational components to healthcare practitioners and public health specialists faced with addressing the evaluation and management of water-related disease resulting from terrorist activity:

### Physician Readiness for Acts of Water Terrorism Educational Components

- Review of the threat of water terrorism in the United States including water as a vehicle for transmission of biological, chemical and radiologic agents.
- Discussion of accurate exposure history-taking techniques and assessment of multiple exposure pathways and contaminant sources as part of a clinical evaluation to accurately diagnose water-related disease possibly resulting from intentional contamination of water reserves.
- Presentation of clinical resources addressing the accurate diagnosis, appropriate medical management, recommended laboratory evaluation, and prevention guidelines for biological, chemical and radiologic compounds that may be used as waterborne agents.
- Specific precautionary guidelines for susceptible populations at increased risk for morbidity and mortality resulting from intentional chemical, biological and radiologic contamination of water supplies.
- Use of epidemiologic clues and syndromic surveillance techniques to detect waterborne terrorism.
- Access to case reporting mechanisms and surveillance requirements for notification of suspected outbreaks or cluster of disease resulting from a potential terrorist water contamination event.
- Discussion of effective risk communication strategies and public affairs procedures for discussing health risks associated with intentional water contamination.

### Clinician On-Line Resources Guide and Targeted Search Engine Tools:

In addition to the educational resources developed and described above, this physician readiness guide also provides access to a wealth of information available through use of targeted search engines and Internet-based references and resources. We have dedicated an entire section of this physician readiness guide to the informational resources posted by various governmental, academic, military and specialty medical organizations addressing physician preparedness. This dedicated section of the readiness guide acts as a **"central access point"** for comprehensive anti-terrorism preparedness resources for medical and public health practitioners. (For more information refer to **Section 7 - Clinician On-Line Resources Guide and Targeted Search Engine Tools**).

**There is a wealth of general and detailed information available on the Internet regarding various aspects of physician preparedness for all forms of terrorism that serve as valuable**

**tools for evaluating water-related disease and water contaminant exposure from terrorist activity.** This posted information includes a full spectrum of resources from clinical practice guidelines to patient fact sheets to appropriate case reporting procedures. However, locating this information is often difficult for most health care practitioners, particularly in an emergency situation. In order to facilitate easy access to reliable web-based information for the busy practicing clinician, we have organized and categorized this specialized information in a manner that incorporates: 1) ease of access for healthcare practitioners and 2) technology support for the physician end-user at every feasible opportunity.

Accessing terrorism preparedness information using general Internet search engines and broad search terms is often inefficient, time consuming and impractical for most practicing healthcare providers. During the development of this educational program, we reviewed hundreds of terrorism preparedness websites hosted by a large pool of medical, governmental, private, academic and professional organizations. We have organized these valuable Internet resources for targeted use by healthcare providers in the following manner:

- **We have summarized over 100 terrorism preparedness websites that we believe provide both reliable and accessible information to healthcare providers faced with addressing various aspects of terrorism preparedness and the recognition, management, and prevention of water-related disease.**
- **We have developed several technology tools to assist the physician end-user of this readiness guide including a series of targeted search engines allowing quick and easy access to valuable information available on the Internet searchable by key word.**

### **Free Access to this Physician Readiness for Acts of Water Terrorism Guide:**

We trust that this Physician Readiness for Acts of Water Terrorism on-line guide will serve as a valuable resource tool in your clinical practice when faced with the possible threat of water terrorism in your community. Access to this on-line resource is provided to healthcare practitioners at no cost as a result of funding provided by the Environmental Protection Agency and the Arnot Ogden Medical Center.

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## SECTION 2

### Understanding the Threat of Water Terrorism



#### Understanding the Threat of Water Terrorism in the United States:

Water supplies and water distribution systems represent potential targets for terrorist activity based upon the common need of this vital commodity to every aspect of our industrialized society (1). Even short-term disruptions of water service can significantly impact a community in myriad ways since the provision of potable water represents an essential component of the nation's infrastructure. **Intentional contamination of a municipal water system as part of a covert terrorist attack could lead to potentially serious medical, public health and economic consequences for a community.** Until recently in the United States, contamination of water reserves and public drinking water systems with biological, chemical or radiologic compounds generally resulted from natural, industrial or unintentional man-made accidents.

Unfortunately, recent terrorist activity in the U.S. has forced the public health community, federal regulatory agencies, and water utilities to consider the possibility of intentional contamination of U.S. water supplies as part of an organized effort to disrupt and damage important elements of our national infrastructure (1-3). In the past, protection of potable water supplies from intentional chemical, biological or radiological (CBR) contamination was a concern for the military tasked with protecting troops from known and potential CBR weapons exposure in the field (4-6). However, there is growing concern that biological, chemical and radiologic warfare agents may be used against the U.S. civilian population with **water as one possible vehicle of transmission or mode of dispersal of weaponized compounds** (1, 2, 3, 7, 8).

The plausibility of intentional contamination of water supplies as part of an overt or covert terrorist act has been reinforced by recent congressional testimony, a consensus statement by a governmental review panel, a joint CDC and EPA water advisory health alert, and several law enforcement reports (9-16). **In addition, in his 2002 State of the Union Address, President Bush noted that captured Al Qaeda documents included detailed maps of several U.S. municipal public drinking water systems** (9). Apprehension regarding a terrorist assault on drinking water systems has also been reinforced by news reports and recent arrests of suspects charged with threatening to contaminate municipal water supplies in the U.S. (3,10-13).

As part of their 2002 congressional report, the National Research Council of the National Academy of Sciences concluded that water supply system contamination and disruption should

be considered a possible terrorist threat in the U.S. (14). Most recently on February 7, 2003, the National Terrorism Threat Level was increased to a "high risk" threat level based upon information received and analyzed by the federal intelligence community (15). Subsequent to this heightened alert, the Centers for Disease Control and Prevention (CDC) and the Environmental Protection Agency (EPA) issued a **Water Advisory in Response to the High Threat Level** (16). This 2/7/03 Health Advisory indicated that:

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*While there are no data to indicate that water has been specifically targeted, our nation's water infrastructure remains at risk to terrorist attacks, or acts intended to substantially disrupt the ability of a water system to provide a reliable supply of water. Therefore, public health agencies and water utilities are encouraged to continue to work together, keep each other informed of any unusual activities, and confirm the proper operation of notification channels in emergency response plans.*

*Public health agencies should immediately notify local water utilities and the state's drinking water administrator in the event of an unusual number of cases of gastrointestinal illnesses or other indications of illness that may suggest water contamination by a biological, chemical or radiological agent.*

*Water utilities should immediately notify public health agencies 24/7 emergency operations number, and the state's drinking water administrator in the event of specific threats received at a water facility, customer complaints in water quality, or if circumstances lead the utility to believe that the water has been or will be contaminated with a biological, chemical or radiological agent.*

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## **Water as a Potential Terrorist Target for Dispersal of Biological, Chemical, and Radiologic Agents:**

Potential vulnerabilities of water supply systems to terrorist threats range from structural damage to water system infrastructure to cyber attacks on supervisory control and security systems to deliberate contamination of water at the supply intake, treatment facility, and within a distribution system (2, 3, 14). Perhaps more threatening than sabotage or disruption of the physical structure of a community's water supply is the threat of deliberate contamination of drinking water with biological, chemical, and radiologic warfare agents (14).

Although the U.S. water systems are more physically secure than ever before with multiple layers of enhanced protection, there are several potential points of contamination that could be targeted for acts of water terrorism. It is important for healthcare providers to have a basic understanding of these system vulnerabilities in order to be able to complete an accurate exposure history when evaluating a suspected case of terrorism-related disease in their clinical practice. **In order to prevent a missed diagnosis of waterborne terrorism, it is vital that healthcare practitioners understand how water could act as a potential exposure pathway or mode of dispersal of CBR agents during a terrorist attack (17).**

In their congressional report addressing infrastructure vulnerability to acts of terrorism, the National Research Council of the National Academy of Sciences have outlined a series of potential points of contamination of the U.S. water supply to acts of overt or covert terrorism (14). Other public health and water specialists have also addressed this issue and presented other possible points of contamination. The following list of potential sources of water contamination is presented for **healthcare providers to keep in mind when evaluating an unusual symptoms complex or an unusual illness pattern in their practice that may be due to waterborne terrorism (1, 8, 14, 18-21):**

## Possible Points of Contamination of U.S. Water From Acts of Terrorism\*

- **Upstream of a community water supply system or collection point** - water supply systems are comprised of small streams and bodies of water, rivers, service reservoirs, aquifers, wells, and dams that may act as points of deliberate contamination of water.
- **Community water supply intake access point or at the water treatment plant** - many water supply systems are designed to receive water from source water reserves at a central intake point with this source water being subsequently filtered and sanitized at the community water treatment facility for eventual distribution as potable water. Both water intake points and a community water treatment plants may be targeted for terrorist activity and deliberate water contamination.
- **Selected points in the post-treatment water distribution system** - treated water is distributed to the water consumer or end-user through transmission pipelines to homes and businesses. Selected portions of a water distribution system or water main are another potential point of water contamination that may affect a subdivision, specific neighborhood, school or hospital if targeted by terrorists.
- **Private home or office building connections, building water supplies or water tanks, cisterns, individual storage tanks** - treated water that is stored very close to the end-user as well as individual house connections may serve as points of contamination of water by terrorists.
- **Water used in food processing, bottled water production, or commercial water** - water used for food processing or preparation as well as bottled water production also represent point of potential water contamination by terrorists.
- **Deliberate contamination of recreational waters and receiving waters** - both treated and untreated recreational waters may serve as a point of potential contamination of water including swimming pools, water parks, and natural bodies of water (small lakes and ponds). Receiving waters such as rivers, estuaries, and lakes may be secondarily contaminated with wastewater from sanitary and storm

sewer systems that may have been environmentally contaminated by a biological, chemical or radiologic warfare agents.

**\*NOTE: A number of the potential points of contamination of water outlined above are more probable terrorist targets than others (2, 14). However, all healthcare providers should keep these sources of potential water contamination and unusual modes of delivery of CBR warfare agents in mind when evaluating a suspected case of terrorism -related disease.**

### Potential CBR Exposure from Water Distribution Systems and Recreational Water:

The biological, chemical and radiologic agents that have been designated as potential terrorist weapons may arise from varied agent sources and be dispersed through multiple exposure pathways including water (1, 3-8). **A key factor in the accurate diagnosis and appropriate management of waterborne disease is inclusion by the healthcare provider of water as one possible exposure pathway for the dissemination of biological, chemical and radiologic agents at the time of initial case presentation.** This physician on-line readiness guide offers four web-based educational tools that have been developed for use by healthcare providers faced with attempting to evaluate and manage a potential case of warfare agent exposure in their patient population.

We have placed the **waterborne route of potential exposure to biological, chemical and radiologic warfare agents in context with other exposure pathways of clinical and public health significance.** These web-based evaluation and management educational tools are offered to enhance the index of suspicion and level of vigilance of healthcare practitioners who will be tasked with evaluating ALL potential avenues of exposure to weaponized agents as part of the terrorist threat in the United States.

Physician Readiness for Acts of Water Terrorism Clinical Educational Tools for Potential Waterborne CBR Exposure
Clinical approach and medical management of BIOLOGICAL AGENTS
Clinical approach and medical management of BIOLOGICAL TOXINS
Clinical approach and medical management of CHEMICAL AGENTS
Clinical approach and medical management of RADIOLOGIC AGENTS

### Public Health Protection and Water Safety and Security Countermeasures:

A major effort has been undertaken to prevent the occurrence and successful implementation of overt and covert acts of water terrorism and to protect and secure public water supplies in the United States (3, 22-25). These countermeasures incorporate local, state and federal protection efforts and safeguards that include but are not limited to:

- Enhancement of the overall security of water utilities including both drinking water and wastewater utility systems nationwide

- Protection of the nation's drinking water and wastewater system infrastructure, supervisory controls, and security hardware systems and technologies
- Improvement of the identification and detection, containment and treatment, and decontamination and disposal of biological, chemical and radiologic contaminants deliberately introduced into drinking water and receiving waters in the environment
- Development of emergency contingency plans in the event of a purposeful attack on a drinking water or wastewater system in the U.S.

These enhanced security countermeasures are intended to protect public health and water safety throughout the United States. Early detection and rapid response to biological, chemical or radiologic terrorist assaults on U.S. water supplies will be critical elements to any effective terrorism response strategy. In the event of any act of water terrorism, **early detection will be critical in order to decrease the public health impact of the contamination event** as well as the secondary disruption to water distribution and the psychological impact of the public's lack of confidence in water safety and quality (1). Early recognition, accurate diagnosis, and conscientious reporting by community healthcare providers of suspected waterborne disease cases will also be essential to maintaining water security and safety.

### Collaboration with Public Health Authorities and Water Utility Practitioners:

Inaccurate assessment by local healthcare providers of the incidence of water-related disease resulting from biological, chemical or radiologic agent exposure may limit the successful implementation of water quality treatment and public health protection strategies in an affected community. A coordinated and effective response to acts of water terrorism will depend upon **cooperation among a multidisciplinary team of healthcare providers, public health and water utility practitioners, law enforcement professionals and community leaders** in order to mitigate the potential impact of an intentional contamination event.

In addition, as a result of heightened public awareness regarding the potential for additional terrorist activity, physicians and other healthcare providers will be required to play a leading role in risk communication with the public, if an act of waterborne terrorism occurs in the U.S. Healthcare providers are among the most trusted sources of information for the general public regarding drinking water quality and safety in the U.S. (17) and community residents will immediately turn to their healthcare providers for advice regarding the safety of their drinking water during an intentional contamination event. **Medical and public health practitioners will be faced with providing credible and timely risk communication** and public notification of a suspected water contamination event in light of the potential for significant concern in the general population resulting from such an event.

Local and state public health agencies and community water utilities can act as invaluable resources to healthcare providers facing these public health challenges and are available for collaboration in every region of the United States. **Physician communication with local public health authorities and water utility practitioners improves water protection efforts and provides early notification of any possible penetration of water treatment facilities.** Reporting any unusual disease trends that may possibly be related to intentional contamination of water (even prior to laboratory confirmation) will allow public health and water treatment interventions to be planned and implemented more effectively.

In addition, local and state public health agencies and water utilities offer significant resources of updated information regarding many aspects of water quality monitoring, treatment protocols, and enhanced security measures for both practicing clinicians and their patients. Two important on-line contact lists are posted below to facilitate communication between healthcare practitioners and public health agencies and water utility practitioners for every region of the United States.

## CONTACT INFORMATION FOR DEPARTMENT OF HEALTH AGENCIES BY STATE

[\(Click here\)](#)

## CONTACT INFORMATION FOR WATER UTILITY PROVIDER BY REGION

[\(Click here\)](#)

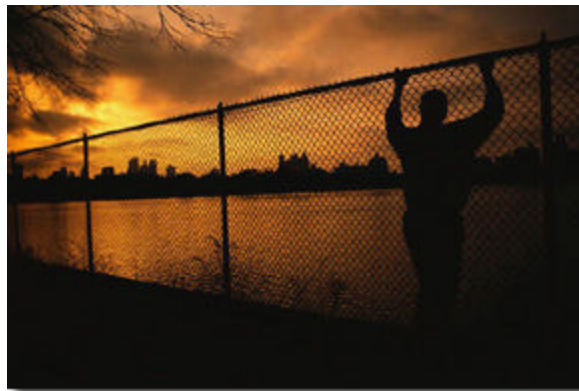
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### SECTION 3

#### Chemical, Biological, and Radiologic Agent Dispersal and Multiple Exposure Pathways



#### Dissemination of Chemical, Biological, and Radiologic Agents Using Multiple Exposure Pathways:

In any release of a biologic, chemical or radiologic compound whether natural or intentional, the nature of the **medical sequelae resulting from the exposure depends upon a multitude of**

**factors** including: 1) the method by which the agent is dispersed, 2) the agent characteristics including toxicity and virulence, 3) the amount of compound released or infective dose, 4) the state of the host susceptibility and personal protection, 5) the routes of exposure to the agent, and 6) the movement and dilution of the agent in the environment (1). Healthcare providers faced with evaluating a suspected case of terrorism-related disease will rarely have access to the type of extensive exposure information listed above when questioning their patients – most of whom may be unaware of intentional chemical, biological or radiological (CBR) agent contact prior to their presentation.

Therefore, **healthcare practitioners will need to become familiar with the various methods of dissemination used for biological, chemical and radiologic warfare agents** in order to effectively recognize cases of terrorism-related exposure and prevent additional cases from occurring in their community. Several important exposure scenarios should be kept in mind by healthcare providers during their diagnostic evaluation of suspicious cases of intentional exposure to CBR agents that may include water as one exposure pathway:

- **Intentional contamination with non-weaponized, naturally occurring agents:** In many cases, terrorism-related disease produced by warfare agents mimics naturally occurring disease since the illness may be caused by the same pathogen or industrial compound or radiologic agent found in a traditional setting (2). Naturally occurring waterborne disease can cause significant morbidity and mortality in a community (3-9). Therefore, intentional contamination of water supplies with non-weaponized, naturally occurring pathogens or contaminants should also be considered a credible exposure source when completing an exposure history of a suspicious case of terrorism-related disease.
- **Different clinical picture with ingestion exposure:** Many CBR warfare agents display a significantly different clinical picture when the route of exposure is ingestion rather than inhalation or dermal absorption. Using food and water supplies as a mode of dispersal for CBR agents (10, 11) may confound diagnosis, delay treatment, and impede protective public health measures if exposure histories are restricted to questions regarding inhalation and cutaneous routes of exposure exclusively (12, 13).
- **Multiple CBR agent exposure and co-infections:** A terrorist attack on the U.S. population may take place with multiple agents resulting in exposed patients presenting with both acute and delayed symptoms and short and long-term medical sequelae from mixed CBR agent exposure (2, 14). Multiple CBR agent exposure could lead to the presence of co-infections and confusing syndromes associated with different chemical or radiologic agents. Co-infections with multiple waterborne pathogens and waterborne exposure to multiple chemical agents are scenarios that clinicians frequently face when evaluating cases of water-related disease from natural or accidental water contamination (15). Therefore, when evaluating a suspected case of terrorism-related disease, the clinician's exposure history and differential diagnosis may need to include the possibility of multiple warfare agent exposure.
- **Water as a CBR agent exposure pathway from both direct and environmental contamination:** Waterborne exposure to CBR agents may result from deliberate direct contamination of water supplies, recreational waters, and receiving waters. However, water may also become indirectly contaminated by CBR agents through environmental contamination of wastewater from such sources as sanitary and storm sewer systems receiving biological, chemical or radiologic warfare agents from an aerosolized attack or a radiologic event.

## Modes of Dispersal of CBR Agents Using Multiple Exposure Pathways or Portals of Entry:

Biological, chemical and radiologic warfare agents include unconventional weapons that may be delivered by non-traditional mechanisms of dispersal through unexpected exposure pathways (1, 2). The **variety of dissemination mechanisms** of these warfare agents is extensive ranging from deliberate release of pathogens to infect food supplies or damage livestock to intentional contamination of the water systems and supplies of a targeted population (1). The **various modes of delivery of warfare agents** include aerosols or aerial sprays, foodborne and waterborne vehicles, vectorborne and dermal delivery, and intentional injection (2, 16).

Warfare agents enter the body through 'portals of entry' of naturally occurring disease and toxin exposure and may be reviewed by their routes of exposure. In addition to understanding the routes of exposure of a specific CBR agent under diagnostic consideration, healthcare providers need to consider other important exposure information for CBR agents including: 1) the **natural reservoirs** of the agent; 2) the potential **vehicles of transmission** of the agent; and 3) the possible warfare or **weaponized modes of delivery** of the agent (1, 2, 16, 17).

A key factor in the accurate diagnosis and appropriate management of waterborne disease resulting from intentional contamination of water is inclusion by the healthcare provider of water as one possible exposure pathway of CBR agents at the time of initial case presentation. **The CBR agents that have been designated as potential terrorist weapons may arise from varied agent sources and be dispersed through multiple exposure pathways including water** (1, 2, 12, 13, 17). In light of the many diagnostic challenges presented by evaluating a suspicious case of waterborne terrorism, an educational tool for healthcare providers has been developed as part of the offerings of this physician on-line readiness guide in **Section 5-Evaluation and Management of Disease Resulting from CBR Agents**.

The summary tables included in **Section 5** present information addressing the natural reservoirs, potential vehicles of transmission, and possible warfare agent modes of delivery for selected CBR agents of concern. **The waterborne route of potential exposure to CBR agents has been placed in context with other exposure pathways of clinical and public health significance when terrorist activity is suspected.** This web-based educational tool is offered to enhance the index of suspicion and level of vigilance of healthcare practitioners who will be tasked with evaluating **ALL potential avenues of exposure to weaponized agents** as part of the terrorist threat in the United States.

**Selected examples of the exposure information posted in [Section 5](#) that may be useful during a clinical evaluation of a suspected case of water terrorism are presented below:**

BIOLOGICAL AGENTS EXAMPLE				
BACTERIAL PATHOGENS				
Etiologic Agent	Natural Reservoirs	Potential Vehicles of Transmission	Possible Biological Warfare Modes of Delivery	On-Line Diagnostic and Medical Management Resources
<b>Anthrax</b> <i>Bacillus</i>	Soil with worldwide	Airborne, foodborne,	Aerosolized spores during a	<a href="#">USAMRIID</a> <a href="#">Summary</a>

<i>anthracis</i>	distribution	vectorborne, cutaneous contact with infected tissue	BW attack, food and direct or incidental water contamination	<a href="#">Clinical Management Fact Sheet</a> <a href="#">Comprehensive CDC Resources</a> <a href="#">Information for Healthcare Providers</a> <a href="#">Virtual Naval Hospital Resources</a> <a href="#">NATO Handbook</a>
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## BIOLOGICAL TOXINS EXAMPLE

### BACTERIAL BIOTOXINS

Etiologic Agent	Natural Reservoirs	Potential Vehicles of Transmission	Possible Biological Warfare Modes of Delivery	On-Line Diagnostic and Medical Management Resources
<b><i>Clostridium Botulinum</i> toxins</b> (collectively BTX)	Soil, animals, fish	Foodborne with consumption of food contaminated with <i>C. botulinum</i> toxin; wound infection from exposure to toxin spores	Primarily aerosol release during BW attack; intentional contamination of food and water possible	<a href="#">USAMRIID Summary</a> <a href="#">Clinical Management Fact Sheet</a> <a href="#">Comprehensive CDC Resource 1</a> <a href="#">Comprehensive CDC Resource 2</a> <a href="#">Information for Healthcare Providers</a> <a href="#">Virtual Naval Hospital Resource</a>

## CHEMICAL AGENTS EXAMPLE

### NERVE AGENTS ("Gases")

Etiologic Agent	Natural Reservoirs	Potential Vehicles of Transmission	Possible Biological Warfare Modes of Delivery	On-Line Diagnostic and Medical Management Resources
<b>G agents (Volatile)</b> - GA (Tabun) GB (Sarin) GD (Soman) <b>V agents (Non-Volatile)</b> - VX	None in nature	Inhalation, ingestion, percutaneous absorption and eye contact	Airborne release, intentional contamination of drinking water, dermal absorption through contaminated water, intentional contamination of food	<a href="#">CDC Comprehensive Res. - Tabun</a> <a href="#">CDC Comprehensive Res. - Sarin</a> <a href="#">CDC Comprehensive Res. - Soman</a> <a href="#">CDC Comprehensive Res. - VX</a> <a href="#">USAMRICD Medical Handbook</a> <a href="#">Clinical Management Fact Sheet</a> <a href="#">ATSDR Medical Guidelines</a> <a href="#">NATO Handbook</a> <a href="#">Review of Medical Aspects</a> <a href="#">Chemical Hazards Algorithm</a>

RADIOLOGIC AGENTS EXAMPLE	
POSSIBLE EXPOSURE PATHWAYS DURING A RADIOLOGIC TERRORISM EVENT	
Potential Exposure Pathways	Nuclear Warfare Agent Source
<b>External Exposure</b>	<p>External radiation exposure from nuclides in the plume after detonation</p> <p>External radiation and contamination from surface-deposited contamination and activation products</p> <p>Personal contamination of skin and clothing</p>
<b>Internal Contamination</b>	<p>Internal contamination from plume inhalation due to nuclides in plume following detonation</p> <p>Internal contamination due to inhalation of re-suspended contamination</p> <p>Internal contamination from inhalation or ingestion from personal contamination</p>

Internal exposure due to ingestion of contaminated  
food and water

Internal contamination through skin or wound  
absorption or deposition from contact with  
contaminated material including water

## Distinguishing Features Between Chemical, Biological, and Radiologic Exposure Events:

In the earliest phases of a terrorist attack - particularly if the event is covert- it may be very difficult to distinguish between a biological, chemical or radiologic event (1). **Physicians and other healthcare practitioners will continue to play a critical role as “front-line responders” particularly since the first casualties of covert terrorist activity are likely to be identified by the medical community heralding the initial indication of an attack (18, 19).** Healthcare practitioners often provide the “early detection system” for possible exposure to CBR warfare agents since humans continue to remain the most sensitive and often the only “detector” of a covert terrorist attack on our population (19-21).

Distinguishing between a covert biological, chemical or radiologic agent exposure can be a significant challenge since the presenting symptomatology of these agents may be similar and both acute and delayed medical sequelae may be present at the same time. Completing an accurate exposure history and assessing the potential modes of delivery of CBR warfare agents will be critical in the event of a covert terrorism event that may include intentional contamination of water. It will be important for healthcare providers to be able to characterize distinguishing indicators of a biological, chemical or radiologic attack including important epidemiologic features (refer to **Section 4- Detection and Diagnosis of Waterborne Terrorism**). Several resources are available online that provide **valuable guidance indicators of each type of event:**

### Different Indicators of a Biological, Chemical or Radiologic Event\*

#### Indicators of a Possible Biological Incident

[http://www.odci.gov/cia/reports/cbr\\_handbook/cbrbook.htm#5](http://www.odci.gov/cia/reports/cbr_handbook/cbrbook.htm#5)

#### Indicators of a Possible Chemical Incident

[http://www.odci.gov/cia/reports/cbr\\_handbook/cbrbook.htm#4](http://www.odci.gov/cia/reports/cbr_handbook/cbrbook.htm#4)

#### Indicators of a Possible Radiologic Incident

[http://www.odci.gov/cia/reports/cbr\\_handbook/cbrbook.htm#6](http://www.odci.gov/cia/reports/cbr_handbook/cbrbook.htm#6)

\* Source: Chemical/Biological/Radiological Incident Handbook (22) accessed at:  
[http://www.odci.gov/cia/reports/cbr\\_handbook/cbrbook.htm#0](http://www.odci.gov/cia/reports/cbr_handbook/cbrbook.htm#0)

Another useful on-line resource that may help healthcare providers during their initial case evaluation outlines several key **epidemiological features and other indicators differentiating a biological and chemical attack** and is posted below:

## Differentiation of biological and chemical attack\*\*

Indicator	Chemical Attack	Biological Attack
<b>Epidemiological features</b>	<p>Large numbers of patients with very similar symptoms seeking care virtually simultaneously (especially with respiratory, ocular, cutaneous or neurological symptoms, e.g. nausea, headache, eye pain or irritation, disorientation, difficulty with breathing, convulsions and even sudden death)</p> <p>Clusters of patients arriving from a single locality</p> <p>Definite pattern of symptoms clearly evident</p>	<p>Rapidly increasing disease incidence (over hours or days) in a normally healthy population</p> <p>Unusual increase in people seeking care, especially with fever, respiratory, or gastrointestinal complaints</p> <p>Endemic disease rapidly emerging at an unusual time or in an unusual pattern</p> <p>Large numbers of patients with rapidly fatal illness (agent-dependent)</p> <p>Patients with a relatively uncommon disease that has bioterrorism potential (e.g. pulmonary anthrax, tularemia, plague)</p>
<b>Animal indicators</b>	<p>Dead or dying animals</p> <p>Absence of insects normally present</p>	<p>Sick or dying animals or fish</p> <p>Unusual swarms of insects</p>
<b>Devices, unusual liquid spray or vapour</b>	<p>Suspicious devices or packages</p> <p>Droplets, oily film</p> <p>Unexplained odour</p> <p>Low clouds or fog unrelated to weather</p>	<p>Suspicious devices or packages</p>

**\*\*Source: Public health response to biological and chemical weapons-WHO guidance (1)** Accessed at: [http://www.who.int/emc/pdfs/BIOWEAPONS\\_exec\\_sum2.pdf](http://www.who.int/emc/pdfs/BIOWEAPONS_exec_sum2.pdf)

## **Host Susceptibility Factors and Vulnerable Population Considerations from CBR Agent Exposure:**

The nature of the medical sequelae resulting from CBR agent exposure depends upon a multitude of factors including: 1) the method by which the agent is dispersed, 2) the agent characteristics including toxicity and virulence, 3) the amount of compound released or infective dose, 4) the **state of the host susceptibility and personal protection**, 5) the routes of exposure to the agent, and 6) the movement and dilution of the agent in the environment (1). The impact of a terrorist attack depends upon not only the type of agent used and method or efficiency of dispersion but also upon the type of population exposed and their level of immunity or vulnerability (23). **Individual host susceptibility and differences in CBR agent virulence and toxicity may result in a wide variation of the infective dose or level of toxicity required to cause disease from waterborne warfare agent exposure (12).**

Water-related disease resulting from intentional contamination with biological, chemical or radiologic agents may present as benign symptoms or self-limited illness in a healthy patient population while the same waterborne exposure in a vulnerable patient population may result in serious illness. **Since individual vulnerability to weaponized compounds including waterborne agents may vary widely, differences in host susceptibility factors may complicate recognition of an intentional water contamination event.** Unfortunately, these

sensitive populations are likely to experience the most drastic health outcomes from any biological, chemical or radiologic contamination event resulting from a terrorist assault on water supplies (15).

When assessing a suspicious case of terrorism-related disease, **healthcare providers will need to be especially vigilant if their patient base includes vulnerable populations most at risk for the medical sequelae of CBR agent exposure**. Important points for healthcare providers to keep in mind as part of their clinical evaluation of susceptible patients potentially exposed to CBR agents include but are not limited to:

- The specific susceptibility of any individual patient to waterborne CBR agent exposure varies widely depending upon several dynamic factors including: 1) the general health status of the patient at the time of exposure; 2) the patient's previous immunologic experience and antibody status; 3) the infective dose or level of toxicity of the CBR agent which may be directly dependent upon the amount of contaminated water consumed over a specified period of time (12, 15, 24).
- Vulnerable populations including children, pregnant women, and the elderly may be disproportionately affected by any biological, chemical or radiologic warfare agent release including the waterborne route of exposure at the time of the direct attack. These vulnerable populations may also be at increased risk for any secondary transmission of a warfare agent, for the chronic disease phase of many CBR agent exposures, and for the long-term medical sequelae resulting from intentional CBR agent release (17, 25-27).

There is a wealth of educational information available on-line for healthcare providers that address several important aspects of diagnosing and managing potential cases of biological, chemical and radiologic terrorism in susceptible populations. These on-line resources also apply to susceptible populations and acts of water terrorism. We have summarized many of these on-line resources and dedicated an entire section to their review which serves as a powerful informational tool for clinicians (click here to view **Section 7: Clinician On-Line Readiness Resource Guide and Targeted Search Engine Tools**). For specific online resources that offer useful information addressing susceptible populations and terrorism click below:

**[ON-LINE RESOURCES FOR MANAGEMENT OF SUSEPTIBLE POPULATIONS](#)**  
**[\(CLICK HERE\)](#)**

**[EVALUATION AND MANAGEMENT OF WATER-RELATED DISEASE IN SUSCEPTIBLE POPULATIONS](#)**  
**[\(CLICK HERE\)](#)**

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## SECTION 4

### Detection and Diagnosis of Waterborne Terrorism



#### Environmental Detection and Monitoring of Potential Waterborne CBR Agents:

Deliberate contamination of the wells, reservoirs and other water sources of both military and civilian populations has been employed as a method of attack by opposing forces throughout the history of war (1). Many armies have resorted to this method of warfare including the Romans who contaminated the drinking water of their enemies with diseased cadavers and animal carcasses (1, 2). With enhanced technology and modern advances, the mechanisms of dispersal of warfare agents have expanded significantly. Whether advanced technology or ancient warfare

methods are used by terrorists, covert contamination of water sources remains a potential threat to public health. In addition, covert terrorist attacks on our population with deliberate release of chemical, biological and radiologic (CBR) warfare agents may be difficult to identify quickly and reliably in the environment (2). **The difficulty of detecting covert terrorist attacks extends to all four potential sources of environmental contamination including air, soil, food and water (3).**

In the event of intentional contamination of water with a CBR agent that is colorless, odorless, tasteless and not detectable by other human senses, environmental detection of the agent may present a challenge (4, 5). Both food and water supplies may be contaminated with CBR agents that do not cause any obvious change in the appearance or physical characteristics of water to patients or water consumers (6, 7, 8). **A major effort has been undertaken to improve and enhance the ability to detect and characterize deliberate contamination of water systems in the U.S.** as part of a collaborative effort by both water utilities and several federal public health agencies (9, 10-13). For example, the National Homeland Security Research Center and the U.S. Environmental Protection Agency have developed the following Water Protection Program:

**U.S. Environmental Protection Agency**

**National Homeland Security Research Center**

**The Water Protection Program**

Primary emphasis of the Water Security Research Program is on water supply, treatment, and distribution infrastructures in U.S. communities. Key research areas are detection and characterization of contaminants, response and mitigation, and prevention and protection.

**Detection and characterization** research is creating rapid screening technologies for the identification of unknown contaminants, while verifying the performance of sensors and biomonitors.

**Response and mitigation** research includes water decontamination techniques and emergency treatment capacity; validation of field portable monitors, point-of-entry and point-of-use devices; and responses to cyber (computerized) or service (electrical/gas) interruptions.

**Prevention and protection** research studies water treatment efficacy, safe transport in distribution systems, and treatment byproducts. This research area also evaluates pilot-plant distribution systems.

A secondary emphasis of the Water Security Research Program is on wastewater treatment and collection infrastructures which include collection (sanitary and storm sewers, or combined sanitary-sewer systems) and impacts on receiving waters such as rivers, estuaries, or lakes.

Source: EPA Water Protection Program. National Homeland Security Research Center, Environmental Protection Agency. Accessed at: <http://www.epa.gov/ordnhsrc/pubs/bookActionPlan031204.pdf> (13)

Early detection and rapid response to biological, chemical or radiologic terrorist assaults on U.S. water supplies will be critical elements to any effective terrorism response strategy. In the event of any act of water terrorism, **early detection will be critical in order to decrease the public**

**health impact of the contamination event** as well as the secondary disruption to water distribution and the psychological impact of the public's lack of confidence in water safety and quality (14). Even short-term disruptions of water service can significantly impact a community in myriad ways since the provision of potable water represents an essential component of the nation's infrastructure. Intentional contamination of a municipal water system as part of a covert terrorist attack could lead to potentially serious medical, public health and economic consequences for a community. Early recognition, accurate diagnosis, and conscientious reporting by community healthcare providers of suspected waterborne disease cases will also be essential to maintaining water security and safety in the future.

### **Use of Diagnostic Indicators and Epidemiologic Patterns to Detect CBR Agent Disease and Waterborne Exposure:**

If real-time environmental detection and identification capacity are not present for an intentional release of a CBR agent, **the first indication of a terrorist attack may be an increased number of patients presenting to their healthcare provider or emergency department with unusual or unexplained illness or injury** (5, 15, 16). Humans continue to remain frequently the most sensitive - if not only detector in many cases - of an intentional CBR agent release (4, 7, 15). Therefore, healthcare providers may be the first to discover that a deliberate dissemination of CBR agent has occurred in a community including intentional contamination of water reserves.

Practicing healthcare providers are likely to be the first to observe unusual illness patterns and must understand their critical role as "front-line responders" in detecting water-related disease resulting from biological, chemical or radiological terrorism. Although detection methods for recognizing intentional contamination of a water supply are improving (9), **the most likely initial indication that a water contamination event has occurred in a community will be a change in disease trends and illness patterns**. This probable scenario would potentially involve a community-wide waterborne disease outbreak or a cluster of water-related cases of chemical or radiologic toxicity in the general population. Therefore, practicing healthcare providers are likely to be the first to observe unusual illness patterns and resultant injury from water-related disease resulting from biological, chemical or radiological terrorism (3).

Clinical detection of a suspicious case of terrorism-related disease is critically important in order for epidemiologic investigations to be initiated and appropriate remediation and prevention efforts to be instituted (5, 15). Unfortunately, the early presenting symptoms of many biological, chemical, and radiologic warfare agents are nonspecific and mimic more common endemic diseases and medical disorders. However, **certain clinical manifestations and disease syndromes may be characteristic of potential terrorist attack using biological, chemical or radiologic warfare agents**. A heightened level of alertness and awareness by healthcare practitioners of these patterns of illness and clusters of disease may enhance the early discovery of a terrorist attack (17).

In order to respond appropriately to the current threat of terrorism and the possibility of intentional exposure of their patients to weaponized CBR agents, **healthcare practitioners will need to 'think like an epidemiologist' when evaluating any suspect case or unusual pattern of disease in their clinical practice** (17). This epidemiological approach will require the healthcare provider evaluating an individual patient with an unusual clinical presentation to consider this patient as a potential member of a larger as yet unrecognized cohort of exposed people. This "sentinel event" may require notification of and further study by public health officials.

A clinician's diagnostic acumen can be augmented by embracing this approach and recognizing that terrorism-related illness may fall into several distinct epidemiologic patterns (17, 18). Several epidemiologic patterns or indicators that may assist healthcare providers diagnose terrorism-related disease have been published and may prove valuable to healthcare providers facing the challenges of diagnosing terrorism-related illness and injury (5, 7, 17, 19-23). **These epidemiologic indicators or sentinel clues may result from multiple exposure pathways**

**including water and have universal application in a clinical setting.** Several of these epidemiologic clues are posted below but are not limited to the following:

### **Epidemiologic Indicators and Sentinel Clues Indicating Possible CBR Agent Exposure and Disease\***

- Point source illness and injury patterns with record numbers of severely ill or dying patients presenting within a short period of time
- Very high attack rates with 60-90 percent of potentially exposed patients displaying symptoms or disease from possible CBR agent exposure
- Severe and frequent disease manifestations in previously healthy patients
- Increased and early presentation of immunocompromised patients and vulnerable population patients with debilitating disease since the dose of inoculum or toxic exposure required to cause disease may be less than for the general healthy population
- "Impossible epidemiology" with naturally occurring diseases diagnosed in geographic regions where the disease has not been encountered previously
- Higher than normal numbers of patients presenting with gastrointestinal, respiratory, neurologic and fever diagnoses
- Record number of fatal cases with few recognizable signs and symptoms indicating lethal doses near a point of dissemination or dispersal source of CBR agents
- Localized areas of disease epidemics that may occur in a specific neighborhood or sector possibly indicating contamination of a selected point in a post-treatment water distribution system
- Multiple infections at a single location (school, hospital, nursing home) with an unusual or rare pathogen
- Lack of response or clinical improvement of presenting patients to traditional treatment modalities
- Near simultaneous outbreaks of similar or different epidemics at the same or different locations indicating an organized pattern of intentional CBR agent release
- Endemic disease presenting in a community during an unusual time of the year or found in a community where the normal vector of transmission is absent
- Unusual temporal or geographic clustering of cases with patients

attending a common public event, gathering, or recreational venue

- Increased patient presentation with acute neurologic illness or cranial nerve impairment with progressive generalized weakness
- Unusual or uncommon route of exposure of a disease such as illness resulting from an waterborne agent not normally found in the water environment

**\*Note – Several epidemiologic patterns are presented above that have been identified as possible clues of a terrorist attack from several public health and military sources (5, 7, 17, 19-23). None of these indicators alone are pathognomonic for terrorism-related disease but are presented as an educational tool for healthcare providers to be aware of possible disease trends that may warrant further investigation.**

Several on-line resources provide valuable reviews of **diagnostic indicators of biological, chemical, and radiologic warfare activity** that may also prove useful as a tool for enhanced recognition and prompt diagnosis of CBR agent exposure by healthcare providers:

Biological, Chemical, and Radiologic Warfare Diagnostic Indicators*
<b>RECOGNITION AND DIAGNOSIS OF A BIOLOGICAL WARFARE EXPOSURE</b> <a href="http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/2ch2.htm">http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/2ch2.htm</a>
<b>RECOGNITION AND DIAGNOSIS OF A CHEMICAL WARFARE EXPOSURE</b> <a href="http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/3ch10.htm">http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/3ch10.htm</a>
<b>RECOGNITION AND DIAGNOSIS OF NUCLEAR WARFARE AGENT EXPOSURE</b> <a href="http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/1ch6.htm">http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/1ch6.htm</a> <small>*Source - NATO handbook on the medical aspects of NBC defensive operations. Accessed at: <a href="http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/toc.htm">http://www.fas.org/nuke/guide/usa/doctrine/dod/fm8-9/toc.htm</a></small>

### **Completion of an Effective Exposure History to Accurately Diagnose Intentional Waterborne Disease:**

In order to effectively utilize the diagnostic indicators and epidemiologic clues presented above, clinicians must "know what to look for" and "know the right questions to ask" during a case evaluation for potential CBR agent exposure in their patients. The vast majority of physicians are unfamiliar with the appropriate questions to ask their patients in order to obtain an **accurate exposure history that will clarify the potential role of waterborne exposure in a suspicious case of terrorism-related disease**. For a review of the potential mechanisms of exposure and points of contamination for acts of water terrorism, refer to **Section 2- Understanding the Threat of Water Terrorism** and **Section 3- CBR Agent Dispersal and Multiple Exposure Pathways** in this Physician On-Line Readiness Guide.

A complete discussion of the potential points of contamination of the U.S. water supply to acts of overt or covert terrorism is presented in **Section 2- Understanding the Threat of Water Terrorism** which provides a valuable "starting point" for completing an accurate exposure history.

The following list of potential sources of water contamination is presented again as an educational tool for **healthcare providers to keep in mind when evaluating an unusual symptoms complex or an unusual illness pattern in their practice that may be due to waterborne terrorism** (4, 5, 7, 14, 24-26).

### Possible Points of Contamination of U.S. Water From Acts of Terrorism\*

- **Upstream of a community water supply system or collection point** - water supply systems are comprised of small streams and bodies of water, rivers, service reservoirs, aquifers, wells, and dams that may act as points of deliberate contamination of water.
- **Community water supply intake access point or at the water treatment plant** - many water supply systems are designed to receive water from source water reserves at a central intake point with this source water being subsequently filtered and sanitized at the community water treatment facility for eventual distribution as potable water. Both water intake points and community water treatment plants may be targeted for terrorist activity and deliberate water contamination.
- **Selected points in the post-treatment water distribution system** - treated water is distributed to the water consumer or end-user through transmission pipelines to homes and businesses. Selected portions of a water distribution system or water main are another potential point of water contamination that may affect a subdivision, specific neighborhood, school or hospital if targeted by terrorists.
- **Private home or office building connections, building water supplies or water tanks, cisterns, individual storage tanks** - treated water that is stored very close to the end-user as well as individual house connections may serve as points of contamination of water by terrorists.
- **Water used in food processing, bottled water production, or commercial water** - water used for food processing or preparation as well as bottled water production also represent point of potential water contamination by terrorists.
- **Deliberate contamination of recreational waters and receiving waters** - both treated and untreated recreational waters may serve as a point of potential contamination of water including swimming pools, water parks, and natural bodies of water (small lakes and ponds). Receiving waters such as rivers, estuaries, and lakes may be secondarily contaminated with wastewater from sanitary and storm sewer systems that may have been environmentally contaminated by a biological, chemical or radiologic warfare agents.

**\*Note:** A number of the potential points of contamination of water outlined above are more probable terrorist targets than others (24, 27). However, all healthcare providers should keep these sources of potential water contamination and unusual modes of delivery of CBR warfare agents in mind when evaluating a suspected case of terrorism-related disease.

Completing an accurate and thorough environmental exposure history is perhaps one of the most important components of a practicing clinician's evaluation of a suspected CBR agent exposure that includes the waterborne route of exposure. **Several on-line resources are available to assist healthcare practitioners complete an accurate exposure history with specific reference to possible waterborne contaminant exposure:**

On-line Exposure History Resources for Waterborne Exposure
<b>Taking an Effective Exposure History for Potential Waterborne Pathogen Exposure</b>
<b>Taking an Effective Exposure History for Chemical Contaminant Exposure</b>
<b>On-Line ATSDR Environmental Exposure History Monograph</b> <a href="http://www.atsdr.cdc.gov/HEC/CSEM/exphistory/pdffiles/exposure_history.pdf">http://www.atsdr.cdc.gov/HEC/CSEM/exphistory/pdffiles/exposure_history.pdf</a>
<b>Health Professionals Drinking Water Outbreak Response Tools</b> <a href="http://www.cdc.gov/ncidod/dpd/healthywater/professional.htm">http://www.cdc.gov/ncidod/dpd/healthywater/professional.htm</a> <a href="http://www.cdc.gov/ncidod/dpd/healthywater/index.htm">http://www.cdc.gov/ncidod/dpd/healthywater/index.htm</a>
<b>Waterborne Diseases Outbreak Report Form</b> <a href="http://www.cdc.gov/healthyswimming/downloads/cdc_5212_waterborne.pdf">http://www.cdc.gov/healthyswimming/downloads/cdc_5212_waterborne.pdf</a>
<b>Recreational Waters Exposure Report Information</b> Due to the size of this PDF file, the pages may take some time to come into view. The screen will remain blank while downloading. Please be patient. <a href="#">Environmental Health Outbreak Investigation Report: Swimming Pool Venue</a>

## **Use of Syndromic Surveillance and Disease Trends to Assist in the Diagnosis of Waterborne Terrorism:**

As was apparent from the deliberate release of weaponized *Bacillus anthracis* through the U.S. postal system in 2001, **discovery of a biological, chemical or radiologic terrorist event may occur in a physician's office, emergency room or out-patient clinic.** Healthcare providers will continue to play a vital role in the discovery phase of recognizing an intentional release of CBR warfare agents as well as managing subsequent disease. Current diagnostic laboratory testing, public health surveillance systems, and notifiable disease reporting have improved significantly but may not be able to detect or prevent an evolving terrorist event or outbreak (17). Therefore, the initial indication and recognition of an intentional release of CBR warfare agent may result

from recognition of characteristic signs and symptoms of presenting patients through a process known as **syndromic surveillance** (17, 20, 28, 29).

Syndromic surveillance monitors disease trends through **grouping cases into syndromes rather than by specific diagnoses**. State and local health departments are developing and implementing syndromic surveillance systems with the intent of detecting terrorist activity earlier than would be apparent from traditional diagnosis-based surveillance systems (30). Syndromic surveillance systems may augment emergency room and hospital diagnosis-based surveillance by adding the ability to quickly identify clusters of acute illness resulting from potential terrorism exposure (31). **Certain syndromes may be characteristic of terrorist activity and enhanced awareness and thoughtful monitoring of these syndromes by healthcare providers may promote early recognition of CBR terrorist events that may include water as one exposure pathway** (17, 20, 23, 28). Clinicians should maintain a high level of suspicion for the following types of syndromes or clusters of disease in their patient population (17, 28, 29):

### Types of Syndromic Clustering of Disease Potentially Indicating CBR Agent Exposure\*

- Gastroenteritis of an apparent infectious etiology, acute toxic chemical exposure or possible acute radiation exposure
- Upper and lower respiratory disease with fever and sudden death of previously healthy patients
- Rash of synchronous vesicular or pustular lesions and fever; presence of erythema, epilation and radiation burns.
- Suspected meningitis, encephalitis, and encephalopathy
- Sepsis or non-traumatic shock
- Unexplained death with a history of fever
- Advancing cranial nerve impairment with progressive generalized weakness

**\*Note: The types of syndromic clustering of disease presented above have been identified as possible indicators of a terrorist attack (8, 17, 28, 29). None of these indicators alone are pathognomonic for terrorism-related disease but are presented as an educational tool for healthcare providers to be aware of possible disease trends that may warrant further investigation.**

Through conscientious and close attention to disease patterns and illness trends, healthcare practitioners can play a significant role in initiating rapid action and prevention measures that can decrease the impact of biological, chemical and radiologic terrorism. Surveillance systems are powerful tools for monitoring possible terrorism-related disease and protecting public health with active clinician involvement and participation. A valuable on-line resource that details the use of

syndromic surveillance and the application to monitoring disease clusters as a complement to emergency department and hospital-based surveillance is presented below:

**Use of Automated Ambulatory-Care Encounter Records for Detection of Acute Illness Clusters, Including Potential Bioterrorism Events**

<http://www.cdc.gov/ncidod/EID/vol8no8/02-0239.htm>

Useful information addressing U.S. surveillance systems and the important role of healthcare provider participation are available at the link below:

**Public Health Emergency Preparedness and Response Surveillance**

<http://www.bt.cdc.gov/episurv/index.asp>

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## SECTION 5

### Evaluation and Management of Disease Resulting from Chemical, Biological and Radiologic Agents



#### Overview of the Clinical Challenge of Waterborne Disease Resulting from Chemical, Biological, and Radiologic Warfare Agents:

Recognizing and treating waterborne disease is a diagnostic dilemma for the majority of practicing physicians in the United States - even in the best of circumstances - let alone in an emergency scenario resulting from waterborne exposure to weaponized agents. In addition, the **changing nature of the terrorist threat includes the continuing emergence of exotic and newly weaponized agents that may be delivered by novel means of dispersal and unusual exposure pathways including intentional contamination of water (1-7).** Therefore, it is not surprising that healthcare providers will face many challenges if required to accurately diagnose and appropriately manage waterborne disease resulting from intentional contamination of water supplies and the water environment.

Without targeted education and access to special resources, most healthcare providers would not be able to rapidly diagnose and treat disease resulting from exposure to biologic, chemical and radiologic agents including exposure from water sources. **Accurate diagnosis and appropriate management of waterborne exposure resulting from acts of water terrorism require specific attention to current and consistently up-to-date reference information.** This physician on-line readiness guide has been developed in order to provide access to clinically relevant and updated information in a format that offers easy access for practicing physicians in a clinical setting.

The biological, chemical and radiologic agents that have been designated as potential terrorist weapons may arise from varied agent sources and be dispersed through multiple exposure pathways including water (1, 2, 4-6). **A key factor in the accurate diagnosis and appropriate management of waterborne disease is inclusion by the healthcare provider of water as one possible exposure pathway for the dissemination of biological, chemical and radiologic agents at the time of initial case presentation.** The purpose of this section of the physician on-line readiness guide is to provide access to the wealth of information available on the Internet in an organized format that allows for streamlined access by healthcare providers faced with attempting to evaluate and manage a potential case of warfare agent exposure in their patient population.

This section of the physician readiness on-line guide offers four web-based educational tools that have been developed for use by healthcare providers in a clinical setting. **We have placed the waterborne route of potential exposure to biological, chemical and radiologic warfare agents in context with other exposure pathways of clinical and public health significance.** These web-based evaluation and management educational tools are offered to enhance the index of suspicion and level of vigilance of healthcare practitioners who will be tasked with evaluating ALL potential avenues of exposure to weaponized agents as part of the terrorist threat in the United States.

Physician Readiness for Acts of Water Terrorism Clinical Evaluation and Management Educational Tools
Clinical approach and medical management of BIOLOGICAL AGENTS
Clinical approach and medical management of BIOLOGICAL TOXINS
Clinical approach and medical management of CHEMICAL AGENTS
Clinical approach and medical management of RADIOLOGIC AGENTS

### On-Line Quick Reference Guides and Rapid Response Cards for Biological, Chemical, and Radiologic Warfare Agents:

In addition to the targeted on-line educational resource tools offered in this physician readiness guide, there are a series of valuable **Quick Reference Guides** and **Rapid Response Cards** that have been developed specifically for healthcare professionals. Many of these on-line references are available as pocket-sized guides and all offer useful summaries for physician and other healthcare professionals preparing for potential acts of biological, chemical and radiological terrorism in their communities that may include waterborne exposure.

On-Line Quick Reference Guides for Biological, Chemical, and Radiological Warfare Agents
New York State Biologic Terrorism Preparedness and Response Card
New York State Chemical Terrorism Preparedness and Response Card
New York State Radiological Terrorism Preparedness and Response Card
AMA Quick Reference Guide to Biologic Warfare
ACP-ASIM Guide to Bioterrorism Identification
ACP-ASIM Guide for Chemical Terrorism Identification

### Collaboration with Public Health Authorities and Notifiable Disease and Case Reporting Requirements in the Event of Terrorist Activity:

If a healthcare provider suspects an act of terrorism is responsible for a patient's symptoms complex or an unusual illness pattern in their practice, **immediate action to contact the**

**appropriate public health authority is essential (8).** This contact is the critical first step necessary in order for the health department to: 1) initiate a prompt investigation; 2) provide guidance to healthcare providers and the affected community; and 3) establish communication and cooperation with other local, state and federal agencies as warranted (8, 9). **Attention to this procedure by healthcare providers is mandatory in order for the appropriate response to a potentially high-risk public health event to occur - one that may include intentional contamination of drinking water supplies.**

The intentional release of *Bacillus anthracis* spores in the U.S. postal system in 2001 reinforced the **importance of the "golden triangle" of communication between clinicians, laboratory microbiologists and public health officials (10).** Coordination and communication between healthcare providers and the public health community is vital to any preparedness response to acts of terrorism including water terrorism for several important reasons including:

- The management of disease resulting from biological, chemical or radiologic warfare agent exposure may not warrant traditional practice procedures such as waiting for laboratory confirmation (9). A suspected case of terrorism exposure or illness should precipitate contact with public health authorities **prior** to laboratory confirmation in most states.
- The rapidity with which healthcare practitioners diagnose and report suspected cases of biological, chemical and radiologic terrorism **allowing for public health agencies to apply preventive and remediation measures** could make the difference between hundreds to thousands of casualties resulting from an intentional contamination event (11). This scenario certainly applies to the public health challenge that would arise from intentional contamination of water. **Conscientious case reporting to the proper public health authorities** will permit public health interventions to be initiated and implemented more effectively since the first indication of intentional use of biological, chemical and radiologic agents is likely to be reported by the medical community (12).
- For healthcare providers facing the possibility of managing cases of exposure to warfare agents in an emergency situation, a well established and well informed peer contact in the appropriate public health department may be "the clinical community's ace in the hole" (13). Reporting suspicious cases to local and state public health departments is generally a legal requirement and in most cases the **case report should be based upon suspicion rather than final diagnosis (14).**

The most critical component for terrorism outbreak detection and reporting continues to be the important role that the healthcare community and local public health departments play in terrorism event recognition (15). **Therefore, EVERY practicing healthcare practitioner should know how to contact their respective local public health department and other state and federal agencies.** Fortunately, there is a wealth of educational information available on-line for healthcare providers in order to facilitate consistent case reporting of suspicious cases of biological, chemical and radiologic terrorism exposure and illness including but not limited to:

On-Line Emergency Response Resources for Healthcare Providers
<a href="#">CDC Public Health Emergency Preparedness and Response: What to do in an emergency</a>
<a href="#">State and Selected County/City Health Department Websites</a>
<a href="#">ATSDR Emergency Response Resources</a>

## National Notifiable Infectious Disease List

### Case Definitions for Infectious Diseases Under Public Health Surveillance

### Notification Procedures and Protocols in the Event of Bioterrorist Event

## Collaboration with Public Health Authorities and Water Utility Practitioners Regarding Decontamination Wastewater Resulting from CBR Agent Exposure:

Contamination of water with an intentional release of biological, chemical or radiologic agents as part of a terrorist attack in the U.S. and the role that healthcare providers play in the recognition of terrorism-related waterborne disease is the primary focus of this physician on-line readiness guide. Protection of water reserves and prevention of direct acts of water terrorism are of paramount concern. However, protecting water systems from **indirect contamination by CBR agents resulting from the procedures and protocols in place in healthcare facilities to decontaminate exposed patients** is also a concern that healthcare providers may need to address in the future (16, 17).

Although patient decontamination procedures for exposure to biological, chemical and radiologic terrorism differ significantly, removal of the CBR agent frequently involves washing the contaminated skin surface with water (16, 17, 18). Depending upon the type of terrorist activity, the potential risk to the environment resulting from these decontamination procedures may range from a temporary risk with rapid environmental degradation of the agent to more long-term public health consequences for an exposed community (16, 19, 20). Another vitally important reason for healthcare providers and healthcare facilities to develop open and fluid communication with public health and water utility authorities is the **potential environmental impact and possible public health consequences of releasing decontamination wastewater into a community's water treatment system following a terrorist event** (16).

In the emergency situation of mass casualties and life threatening scenarios resulting from a terrorist event, healthcare facilities could certainly be justified in their decision not to contain decontamination wastewater (16). The installation of large volume wastewater containment systems is often cost-prohibitive and the disposition of contaminated wastewater a serious financial challenge (16). However, in the event that a healthcare facility or emergency department is not able to contain decontamination wastewater, appropriate public health and water utility authorities should be notified of the emergency event. Rapid environmental monitoring and remediation may be initiated by public health and environmental health officials -- if they are conscientiously informed by healthcare providers of the decontamination procedures underway in their healthcare facility (16, 21).

## Additional On-Line Clinical Resources for Evaluation and Management of Waterborne Disease Resulting from Chemical, Biological, and Radiologic Warfare Agents:

In addition to clinical evaluation and management of suspected cases of biological, chemical and radiologic terrorism, the **medical community must also prepare for additional laboratory diagnostic and prevention measures** such as: 1) recommended laboratory diagnostics for potential warfare agents, 2) disease-specific infection control measures resulting from biological agent exposure, and, 3) specific patient decontamination protocols resulting from chemical and radiologic warfare agent exposure. In addition, special prevention guidelines and management protocols may be necessary for patients who are members of a susceptible population at increased risk for morbidity and mortality resulting from exposure to biological, chemical and

radiologic agents. These susceptible populations represent those patients who may be most at risk for the medical sequelae resulting from acts of water terrorism.

There is a wealth of educational information available on-line for healthcare providers that address **several important aspects of diagnosing, controlling, and preventing additional cases biological, chemical and radiologic terrorism that also apply to acts of water terrorism**. Useful online resources include but are not limited to

On-Line Clinician Information Exchange and Notification Networks
<a href="#">Johns Hopkins University Clinicians' Biodefense Network</a>
<a href="#">CDC Health Advisory Network</a>
On-Line Diagnosis, Control and Prevention Resources for Medical Consequences of Warfare Agent Exposure
Laboratory Diagnostic Resources
<a href="#">Laboratory Diagnostics</a> <a href="#">CDC Public Health Emergency Preparedness and Response-Laboratory Information</a> <a href="#">CDC Biosafety in Microbiological and Biomedical Laboratories</a> <a href="#">Virtual Naval Hospital Specimen Collection Information</a> <a href="#">Virtual Naval Hospital Identification Methods for Biological Warfare Agents Information</a> <a href="#">ATSDR Emergency Response Resources</a>
Infection Control Resources
<a href="#">Infection Control</a>
Patient Decontamination Resources
<a href="#">Patient Decontamination</a>
Resources for Management of Susceptible Populations
<a href="#">Susceptible Populations</a> <a href="#">Evaluation and Management of Water-Related Disease in Susceptible Populations</a>

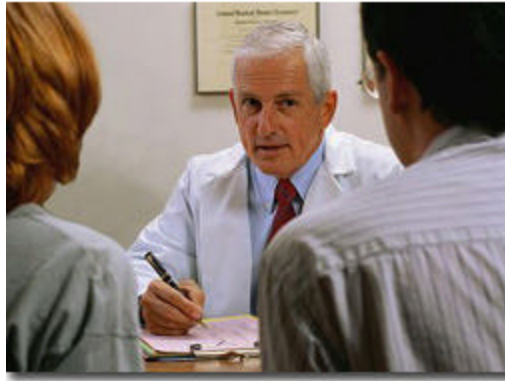
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## SECTION 6

### Clinician Role in Community Readiness and Risk Communication



#### Physician Role in Local Preparedness and Community Readiness for Acts of Water Terrorism:

The initial response to an intentional release of biological, chemical or radiologic warfare agents on the U.S. civilian population will be an inherently local responsibility in most circumstances (1, 2, 3). Once a terrorist event has been identified, local public health agencies, first responders and healthcare practitioners may need to function without external assistance or resources for at least 6 to 8 hours in many locations across the nation (2). In all terrorist response scenarios including acts of water terrorism, local community physicians and medical centers will need to provide acute and follow-up care as well as address the societal concerns of their patients and affected community with effective risk communication (2-5).

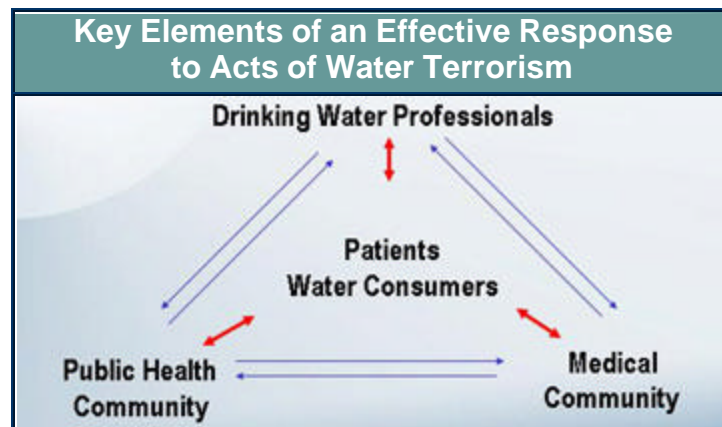
In their consensus report addressing medical preparedness for terrorism, the **American Medical Association presented four key points that must be addressed in order for the medical community to be prepared to detect and manage a terrorist event in their community (2).** This list reinforces the critical role of community physicians in all aspects of terrorism preparedness and response and, as such, has been incorporated as the central focus of this physician on-line readiness guide:

1. Community responses to disasters including terrorism require physician participation.
2. The public health response to acts of terrorism cannot begin unless clinicians report unusual disease cases and cluster.
3. Physicians will be more effective in their community response if prepared with appropriate education and training.

4. Physician educational materials addressing physician-specific issues need to be developed and disseminated in order to address terrorism preparedness and response by the medical community.

The importance of an individual clinician in terrorism preparedness and response is now fully appreciated after an astute Florida physician alerted the health department of an unusual gram stain initiating the anthrax outbreak investigation of 2001 (6). All healthcare providers - no matter what their specialty - must understand their important role as active participants in domestic preparedness against intentional release of CBR agents in their community (7-10). Accurate assessment and prompt reporting by local healthcare providers of the incidence of water-related disease resulting from potential exposure to biological, chemical or radiologic agents will be **critical to the successful implementation of water quality treatment and public health protection strategies in an affected community.**

A coordinated and effective response to acts of water terrorism will depend upon **cooperation among a multidisciplinary team of healthcare providers, public health and water utility practitioners, law enforcement professionals, and community leaders** in order to mitigate the potential impact of an intentional contamination event. Local and state public health agencies and community water utilities will need to partner with healthcare providers in order to effectively address the public health challenge of water terrorism in the United States. The sharing of information among the medical, public health and water community serves as the best protective strategy for defense against intentional acts of water terrorism as presented below:



Preservation of water quality and security and protection of public health from a terrorist assault requires a multi-disciplinary effort from diverse disciplines that are not used to working together traditionally. Each member of the triad presented above must understand their critical role and the importance of: 1) coordinating their efforts, 2) communicating effectively, and 3) working together as a team to protect the nation's drinking water and public health.

**Physician communication with local public health authorities and water utility practitioners improves water protection efforts and provides early notification of any possible penetration of water treatment facilities.** Reporting any unusual disease trends that may possibly be related to intentional contamination of water (even prior to laboratory confirmation) will allow public health and water treatment interventions to be planned and implemented more effectively. In addition, local and state public health agencies and water utilities offer significant resources of updated information regarding many aspects of water quality monitoring, treatment protocols, and enhanced security measures for practicing clinicians, their patients, and water consumers.

## Practicing Physicians as Risk Communicators Following a Waterborne

## Terrorism

## Event:

If an act of waterborne terrorism occurs in the U.S., physicians and other healthcare providers will be required to play a leading role in risk communication with the public. Healthcare providers are among the most trusted sources of information for the general public regarding drinking water quality and safety in the U.S. (5) and **community residents will immediately turn to their healthcare providers for advice regarding the safety of their drinking water during an intentional contamination event.**

**Medical and public health practitioners will be faced with providing credible and timely risk communication** and public notification of a suspected water contamination event in light of the potential for significant concern in the general population resulting from such an event. Physicians would need to immediately collaborate with the local public health specialists and water utility practitioners following an intentional water contamination event in their community. A discussion of collaboration and cooperation with public health specialists, water utilities, and healthcare providers is presented in [Section 2 - Understanding the Threat of Water Terrorism](#) of this on-line physician readiness guide and is available by clicking below:

[Collaboration with Public Health Authorities and Water Utility Practitioners](#)  
(CLICK HERE)

Effective communication by healthcare providers will play an important part in any community terrorism preparedness and response plan - not only communication with public health and water utility authorities - but also with the public to prevent panic and hysteria in the community experiencing the intentional terrorism exposure event (11, 12). Integrating the public and patients as key partners in the medical and public health communication and education response to a terrorism event can help modulate the ultimate impact of the effect on a community. **Healthcare providers will need to embrace the concept that providing information may be as important as providing medical care in the event of a terrorist event (11)** - a concept that directly applies to acts of water terrorism.

Several on-line risk communication resources have also been developed to assist healthcare providers communicate with the public following a terrorist event that have universal application to the risk communication required after an act of water terrorism. A summary of several on-line resources is presented below.

<b>Risk Communication Guidelines and Resources for Communicating with the Public and Media Following a Terrorism Attack</b>
<b>Guidelines for Including the Public in Medical and Public Health Responses to Terrorism</b> <a href="http://www.journals.uchicago.edu/CID/journal/issues/v34n2/011333/011333.html">http://www.journals.uchicago.edu/CID/journal/issues/v34n2/011333/011333.html</a> <a href="http://www.journals.uchicago.edu/CID/journal/issues/v34n2/011333/011333.web.pdf">http://www.journals.uchicago.edu/CID/journal/issues/v34n2/011333/011333.web.pdf</a>
<b>CDC Risk Communication Resources</b> <a href="http://www.cdc.gov/od/oc/media/">http://www.cdc.gov/od/oc/media/</a>
<b>ATSDR Health Risk Communicator</b> <a href="http://www.atsdr.cdc.gov/HEC/HRC/hrchome.html">http://www.atsdr.cdc.gov/HEC/HRC/hrchome.html</a>
<b>National Education Association (NEA) Crisis Communications Guide</b> <a href="http://www.nea.org/crisis/">http://www.nea.org/crisis/</a>
<b>NYS Bioterrorism/Risk Communication/Disaster Preparedness Resources</b> <a href="http://www.health.state.ny.us/nysdoh/bt/links.htm">http://www.health.state.ny.us/nysdoh/bt/links.htm</a>
<b>WaterHealthConnection.org</b>

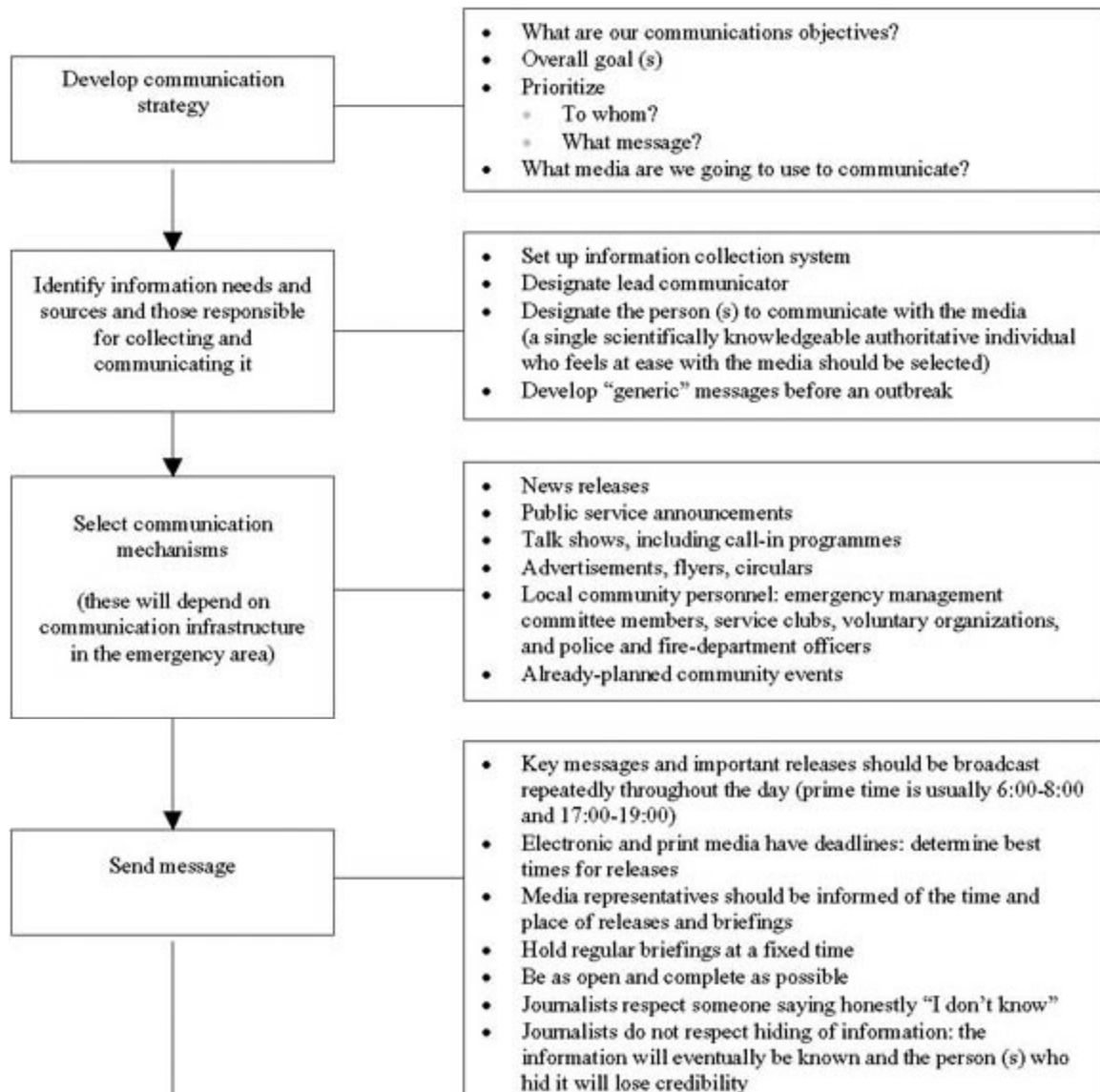
Health Risk Communication and Patient Risk Evaluation for Waterborne  
Contaminant  
Exposure and Water-Related Disease

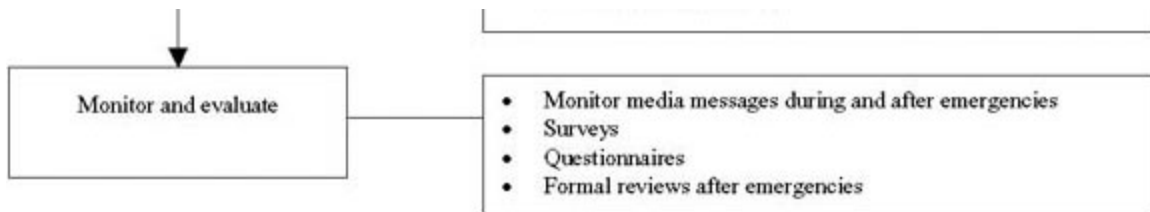
**Public Communication and Information Strategies Following a CBR Agent  
Exposure**

[http://www.who.int/emc/pdfs/BIOWEAPONS\\_exec\\_sum2.pdf](http://www.who.int/emc/pdfs/BIOWEAPONS_exec_sum2.pdf)

An excerpt from the World Health Organization on-line resource listed above is presented below that provides a useful guideline for healthcare providers faced with communicating with their patients, their community and their local media following an intentional CBR agent release:

**A Five Step Process for Communicating with the Public  
Following a CBR Terrorist Attack\***





\*Source: Public health response to biological and chemical weapons-WHO guidance. Posted by the World Health Organization. November, 2001. Accessed at: [http://www.who.int/emc/pdfs/BIOWEAPONS\\_exec\\_sum2.pdf](http://www.who.int/emc/pdfs/BIOWEAPONS_exec_sum2.pdf)

[Click here for a printable version of the image above](#)



In addition to on-line risk communication guidelines and educational tools that are summarized in the table above, the medical community must also be prepared to address other varied aspects of risk communication including the special needs of susceptible populations and risk reduction strategies as part of the management of the medical consequences of CBR warfare agent exposure. We have summarized several additional on-line resources in **Section 7: Clinician On-Line Readiness Resource Guide and Targeted Search Engine Tools** which are accessible at the link below:

### **Additional On-line Risk Communication Resources**

#### **Physician Readiness Training Opportunities and On-Line Educational Training Options:**

Education of healthcare providers, public health officials and first responders is **a crucial element to the prompt recognition, treatment, and prevention of the medical consequences of weapons of mass destruction exposure** (13, 14). Healthcare providers must become familiar with not only the clinical presentation, diagnosis, management and prevention of terrorism-related disease in their patients but also the appropriate mechanisms for communicating with law enforcement agencies, public utilities, the media and the concerned public (15, 16).

**Specialized training for healthcare providers and access to targeted information by the medical community will be essential to any effective response to acts of water terrorism** for several reasons:

- The illness and injury resulting from civilian exposure to weapons of mass destruction agents would not be part of any healthcare provider's routine clinical practice experience (13, 17, 18). A terrorist assault on water supplies may potentially involve use of weaponized and "exotic" or unusual biological or chemical agents.
- The majority of practicing physicians in the U.S. have received no formalized training in the recognition and evaluation of waterborne disease or in the management of the short- and long-term health effects of water contamination.
- Most practicing physicians and healthcare providers are poorly prepared to detect water-related disease resulting from intentional biological, chemical or radiologic contamination and may not be adequately trained to respond appropriately to a terrorist assault on water (5).

The results of a recent national survey of approximately 1000 family physicians revealed that the **greatest predictor of being able to respond to bioterrorism was "knowing how to get information in the event of a suspected attack" including clinical information** (19). The

need for immediate access to specialized information and reference materials by the medical community is particularly important when addressing the recognition and management of acts of water terrorism since the consequences of intentional contamination of drinking water could have serious public health consequences. Therefore, clinicians will need to have access to immediately available and constantly updated information in order to respond to the medical and public health needs of their community (18) subsequent to any act of water terrorism.

**The primary purpose and educational intent of this Physician Readiness for Acts of Water Terrorism on-line guide is to address the critical need for healthcare providers to have streamlined access to resources that will help guide them through the recognition, management and prevention of water-related disease resulting from intentional acts of water terrorism.** The changing nature of the terrorist threat that includes the continuing emergence of exotic and weaponized agents as well as new modes of dispersal requires specific attention to current and consistently up-to-date reference information. This physician on-line readiness guide has been developed in order to provide access to clinically relevant and updated information in a format that offers easy availability to practicing physicians in a clinical setting.

Other educational tools for healthcare providers and preparedness training for the medical community have been summarized in **Section 7: Clinician On-Line Readiness Resource Guide and Targeted Search Engine Tools** which are accessible at the link below:

### **[Additional On-line Physician Preparedness Education and Training Opportunities Resources](#)**

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## SECTION 7

### Clinician On-Line Resources Guide and Targeted Search Engine Tools



#### Clinician On-Line Resources Guide and Targeted Search Engines:

The growing threat to our national security underscores the urgency for the medical community to recognize unusual disease trends and early warning signs of exposure to biological, chemical or radiologic agents that may be used as covert weapons during a terrorist assault – an assault that

may include intentional contamination of water. Practicing healthcare providers are likely to be the first to observe unusual illness patterns and must have access to constantly updated information in order for the early detection of a waterborne terrorist assault to occur followed by appropriate case reporting and disease management. This important section of our Physician Readiness Guide for Acts of Water Terrorism summarizes Internet-based informational and educational resources that are intended to provide access to **current and updated terrorism preparedness information** relevant to your clinical practice. This Clinician On-Line Resources Guide and the Targeted Search Engines Tools have been developed to act as a "**central access point**" to comprehensive anti-terrorism preparedness resources posted by various governmental, academic, military and specialty medical organizations.

**There is a wealth of general and detailed information available on the Internet regarding various aspects of physician preparedness for all forms of terrorism that serve as valuable tools for evaluating water-related disease and water contaminant exposure from terrorist activity.** This posted information includes a full spectrum of resources from clinical practice guidelines to patient fact sheets to appropriate case reporting procedures. However, locating this information is often difficult for most healthcare practitioners, particularly in an emergency situation. In order to facilitate easy access to reliable web-based information for the busy practicing clinician, we have organized and categorized this specialized information in a manner that incorporates: 1) ease of access for healthcare practitioners and 2) technology support for the physician end-user at every feasible opportunity.

### **100 Most Useful Terrorism Preparedness Websites for Clinicians:**

Accessing terrorism preparedness information using general Internet search engines and broad search terms is often inefficient, time consuming and impractical for most practicing healthcare providers. This physician on-line readiness guide has been prepared with the intent of providing current and accurate educational information in a "user friendly" format for clinicians. During the development of this web-based program, we reviewed hundreds of terrorism preparedness websites hosted by a large pool of medical, governmental, private, academic and professional organizations. We have organized these valuable Internet resources for targeted use by healthcare providers in the following manner:

- We have summarized over **100 terrorism preparedness websites** that we believe provide both reliable and accessible information to healthcare providers faced with addressing various aspects of terrorism preparedness and the recognition, management, and prevention of water-related disease.
- We have developed several technology tools to assist the physician end-user of this readiness guide including a **targeted search engine and general Internet search engine** allowing quick and easy access to valuable information available on the Internet searchable by key word or concept.

Whenever possible during our website review process, we attempted to incorporate the guidelines set forth by the [American Medical Association](#) and the [American College of Preventive Medicine](#) addressing medical and health information presented on the Internet. In addition, we followed the quality standards and code of conduct developed by the nonprofit organization, [Health on the Net Foundation](#) (HON).

To view ALL of our **RESOURCES GUIDE 100 MOST USEFUL WEBSITE** summaries click below. We have also organized an additional resource that provides access to a **VIRTUAL LIBRARY OF ON-LINE TEXTS AND PDF REPORTS** that address many important aspects of terrorism preparedness and waterborne disease and the health effects of intentional water contamination. Many of these on-line texts and PDF reports are searchable by key word.

## Terrorism Preparedness - 100 Most Useful Websites

### Virtual Library of On-Line Texts and PDF Reports

#### Resource Guide Targeted Internal Search Engines:

The number of terrorism preparedness websites has exploded since the September 11 attacks followed by the anthrax exposure incidents. The sheer number of resources can be overwhelming if not organized in a fashion that allows quick and easy retrieval of information relevant to the clinical setting. As a result we have developed a **series of 10 targeted search engines addressing several important aspects of physician anti-terrorism preparedness** that streamlines access to the valuable on-line resources that we have reviewed and summarized for use in a clinical setting:

#### Targeted Search by Category

[Biological Agents](#)

[Biological Toxins](#)

[Chemical Agents](#)

[Radiologic Agents](#)

[Susceptible Populations](#)

[Laboratory Diagnostics](#)

[Infection Control](#)

[Patient Decontamination](#)

[Risk Communication](#)

[Physician Preparedness Training Opportunities](#)

If you would like to search for a specific topic in our **RESOURCES GUIDE 100 MOST USEFUL WEBSITE** summaries, we have created another search engine tool that allows for specific queries by WMD agent, medical management guidelines, or agency offerings, etc.

#### Resource Guide Search by Topic or Agency:

Here are a few examples:

Tularemia

Trichothecene mycotoxins

Blistering agents

Nerve agents

Medical management guidelines

Bioterrorism and epidemiology

Children and terrorism

CDC Sites

#### 100 Most Useful Websites Summary Content Guide:

Every website summary in this Clinician On-Line Resources Guide and Targeted Search Engine

section is displayed within a quick reference grid. The grid, shown below, designates the type of content posted at each website that we have summarized:

Site Content Key	
Biological Agent:BA	Chemical Agent: CA
Susceptible Populations:SP	Infection Control: IC
Risk Communication: RC	Biological Toxin:BT
Radiologic Agent:RA	Laboratory Diagnostics: LD
Patient Decontamination:PD	Preparedness Training:PT

## Website Summary Example

### Virtual Naval Hospital: Treatment of Biological Warfare Agent Casualties – ON-LINE TEXT

BA BT LD IC PD

This comprehensive medical guide serves as a reference for medical personnel and targets the recognition and treatment of biological warfare (BW) agent exposure. **Diagnostic and management information contained in this publication may also be relevant for the diagnosis and treatment of patients with naturally acquired disease or illness patterns due to pathogens with BW potential.** This on-line text classifies and describes potential BW agents; provides procedures for collecting, handling and labeling, shipping and identifying potential BW agents; details procedures for diagnosing, treating, and managing BW exposure; and reviews medical management and treatment in BW operations. The on-line text covers: 1) bacterial agents including Anthrax, Brucellosis, Melioidosis, Glanders, Plague, Q-Fever, Tularemia; 2) viral agents including Smallpox, Venezuelan Equine Encephalitis, Viral Hemorrhagic Fevers; and biological toxins including Clostridium Botulinum Toxin, Clostridium Perfringens Toxin, Ricin, Saxitoxin, Staphylococcal Enterotoxin B, Trichothecene Mycotoxins. The website also offers a downloadable PDF version amenable to use as a medical reference guide in an out-patient office or emergency department setting.

Website Contact Information

Internet Address: <http://www.vnh.org/FM8284/index.html>

## Section 8

### Glossary of Disaster Preparedness Terms



Healthcare providers are often required to understand and interpret a diverse array of technical terms and scientific concepts during an

evaluation of a patient with potential exposure to weapons of mass destruction (WMD) including unfamiliar biological, chemical, radiologic and military terminology. In addition, patients may present information to their treating physician from various sources that require translation and explanation by the healthcare provider as part of patient education and risk communication efforts. Therefore, we have incorporated definitions and associated explanations for approximately 1600 disaster preparedness and WMD-related terms for easy access by the healthcare provider end-user of this on-line readiness guide.

You will note that we have incorporated technical definitions and associated explanations from several sources including glossaries prepared by the Centers for Disease Control and Prevention (CDC), U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), U.S. Navy Hospital, and the Central Intelligence Agency (CIA). Some terms have more than one definition based upon the organizational source for that definition. These definitions and associated explanations should provide the healthcare provider with a basic working knowledge of the terminology necessary to understand weapons of mass destruction in relationship to waterborne disease and the health effects of intentional water contamination.